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ABSTRACT

To study the effectiveness of reinforcement management (contigency management) as applied to a military program of instruction already in operation, 335 students in an Army clerk-typist course in which self-paced instruction is used were given points for successive approximations to desired learning behavior. The points were exchangeable later for varying lengths of time off. Only trainees of high initial typing skill were found to have been significantly affected by the experimental program. The selective impact of contingency management found in this population is examined in terms of present military conduct of self-paced instruction, and in terms of military management of motivation and training. (The document includes 66 references.) (Author/LY)

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Technical Report 69-17

Reinforcement Management: An Approach to Motivating Army Trainees

by

Barrie Cassileth

HumRRO Division No. 2

November 1969

Prepared for:

Office, Chief of
Research and Development
Department of the Army

Contract DAHC 19-70-C-0012

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HUMAN RESOURCES RESEARCH ORGANIZATION

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HumRRO Division No. 2
Fort Knox, Kentucky

HUMAN RESOURCES RESEARCH ORGANIZATION

Technical Report 69-17
Basic Research 18

The Human Resources Research Organization (HumRRO) is a nonprofit corporation established in 1969 to conduct research in the field of training and education. It is a continuation of The George Washington University Human Resources Research Office. HumRRO's general purpose is to improve human performance, particularly in organizational settings, through behavioral and social science research, development, and consultation. HumRRO's mission in work performed under contract with the Department of the Army is to conduct research in the fields of training, motivation, and leadership.

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

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FOREWORD

The objective of Basic Research 18, Reinforcement Management, was to examine the applicability and effectiveness of reinforcement (contingency) management as a means of motivating military trainees. This study, undertaken in the fourth quarter of FY 1967, was proposed by HumRRO after a number of civilian studies and empirical demonstrations suggested that this approach is useful in dealing with problems related to improving motivation and achievement.

BR-18 research was conducted at HumRRO Division No. 2 at Fort Knox, Kentucky, under the supervision of Dr. Norman Willard, Jr., Director of Research. Dr. Donald F. Haggard is the present Director. The research was performed and most of the report preparation completed while HumRRO was part of The George Washington University.

Support was provided by the U.S. Army Armor Human Research Unit, LTC William Q. Harty, Chief. CPT Peter P. Horoschak, Operations Officer at the Unit, effected coordination between HumRRO and the training school, assisted with procedural planning, and supervised the experimental phase of the research effort.

HumRRO research for the Department of the Army is conducted under Contract DAHC 19-70-C-0012 with Basic Research under Army Project 2Q061102B74B, Basic Research in Psychology and Social Science.

Meredith P. Crawford
President
Human Resources Research Organization

SUMMARY AND CONCLUSIONS

Military Problem

Major improvements in the effectiveness and efficiency of training can have substantial impact on improving Army activities overall, since training is a major operational activity of the service and involves a high proportion of personnel and resources. Consequently, managers and other personnel in the Army training system are greatly interested in new and improved techniques for improving all aspects of training, including motivation.

Research Problem

Contingency (or reinforcement) management has been shown to be effective as a means for improving motivation for learning in a variety of studies in civilian contexts. These techniques for managing the specific results of behavior appear to have particular promise in military training systems, especially under self-paced learning conditions and in situations where motivation is not intrinsic to the learning task.

While civilian experience has shown these techniques to be effective, their applicability and effectiveness in developing, maintaining, and increasing motivation in Army training requires assessment in a military context. To provide such assessment, two specific research objectives were formulated: (a) to test contingency management techniques in an ongoing self-paced Army training program, and (b) to attempt to identify factors in the training system that affect the applicability of reinforcement management techniques.

Approach

One hundred seventy-three students, all of the active-duty trainees in three successive classes of a self-paced training program for clerk-typists at Fort Knox, were used as experimental subjects. Greater than average effort was rewarded whenever it appeared. Points, awarded daily to the experimental classes for speedy learning, were exchangeable at any time for a series of rewards consisting of varying lengths of time off. The major criterion of achievement for the experimental classes, the number of days they required to complete the course, was compared with that for the control classes. Control classes were the three consecutive clerk-typist school classes to complete training just before the experimental classes began. There were 162 students in the control group. The experimental system was established by the research team and managed jointly by them and the school.

Results

Contingency management was found to be effective in motivating trainees of high initial typing ability; these trainees completed training in about three-quarters of the time it took comparable trainees in the classes using standard procedures. For lower ability trainees there were no significant differences between the contingency management and standard classes. Incompatibilities between the motivational innovation and the existing training system appeared to have influenced research results substantially.

Conclusions

Contingency management appears to be a simple and effective means of motivating at least some kinds of students in military training programs. Superimposing the training innovations on an existing training system without adjusting that system to accommodate new methods should be viewed as a possible explanation for the selective effect. Thoroughly controlled "pilot" programs and specific guidelines for the management of training and motivation in feasibility tests are required for the value of an innovation to be established. An innovation in training will typically require adjustment in other aspects of the existing training system to allow full realization of its potential.

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1	Summary of Mean Days Required for Experimental and Control Classes to Complete the Course (by Initial Typing Skill Level)	9

Reinforcement Management: An Approach to Motivating Army Trainees

INTRODUCTION

MILITARY PROBLEM

Existing Motivation Systems and Problems. Frequent messages from U.S. Continental Army Command, and a recommendation of the Armor Panel of the U.S. Army Armor Center confirm the awareness by the military of a need for new and improved techniques to increase motivation in Army trainees.

Since 1951 several reports and studies on the subject have been published by various military branches (1-13). Except for an article by Fink and Gray in 1953 (1), in which the effects of specific orientation procedures were evaluated, and a 1968 report by Bialek and McNeil (5), in which a scale of rewards for Army trainees was described, the publications were devoted to general reviews of motivation, and to broad recommendations for military instructors. No study was addressed to a review of existing motivation practices and their relative merits; nor was any publication directed to the question of when and where to apply which kind of motivation most advantageously.

Guidelines for the military instructor, who may have had no formal training in the fundamentals of motivation, are nonexistent. Faced with the problem of instilling in his trainees some desire to achieve, the instructor therefore is forced to draw upon his own experience.

Self-Paced Instruction. Self-paced instruction, of current interest and popularity in civilian education, is receiving attention from the military as well. Several combat support training courses have been, or are in the process of being, converted to self-paced systems. There is at present no motivation package to accompany this training material. A student must have a motive to succeed when instruction is self-paced no less than when a traditional academic approach is used. Self-paced instruction will succeed only insofar as the trainee is motivated to take advantage of the personalized mobility it affords. A block of self-paced material is an incomplete package; the instructor needs directions on how to get the student successfully through the block as fast as his ability allows. Specific directions explaining how to make use of existing motivation, or how to instill motivation if there is none, should accompany self-paced material in each training area.

REINFORCEMENT MANAGEMENT[1]

Description

The law of reinforcement states that behavior which is rewarded will strengthen and tend to recur, and that behavior which is met with neutral or negative environmental reaction will weaken and tend to disappear. Contingency management is a procedure by which the law of reinforcement may be applied to practical affairs. By managing the results, or contingencies, of specific bits of behavior, behavior itself may be shaped according to a

[1] What has been termed here, for military purposes, "reinforcement management," is called "contingency management" in psychological literature. The terms are here used interchangeably.

predetermined plan or goal—for example, a child's undesirable behavior, if carefully and planfully ignored or punished, can be made to disappear. Conversely, the same behavior can be maintained or increased by reward or encouragement (e.g., attention).

When there is no conscious management of behavioral results, accidental contingencies are free to operate and to shape behavior in a random manner. In managing contingencies, desired behaviors or reactions are followed by a positive reinforcing event, whereas undesired behaviors are ignored or followed by negative reinforcement, such as punishment.

Theoretical aspects, implications, and ramifications of contingency management and of reinforcement concepts are discussed by Premack (14-20), Homme (21-23), and Eisenberger (24). Premack took full advantage of the reinforcing effect of permission to engage in a personalized, preferred activity. On the basis of this effect, a system of reinforcement has been developed that is especially suitable with contingency management, in which opportunity to engage in preferred behaviors is used as reward.

Civilian Use of Contingency Management

A great deal of research has shown the consistently effective results of contingency management techniques. In some studies Premack's preferred, or high probability, behaviors have been used as reinforcement; in others, more conventional reward systems have been adopted.

Studies dealing with the retarded (25-29) indicate that systematic application of consequences can alter behavior patterns in this population. Deviant and psychotic behaviors were successfully attacked through the systematic reinforcement of incompatible desired activities (30-42).

Research with children (43-58) has shown contingency management to be highly effective with various age groups, ranging from preschool to adolescent children, under a variety of circumstances. Homme (53) in a model study was able to control the behavior of a group of nursery school children by awarding them tokens, later exchangeable for preferred-activity rewards, for desired behavior (namely, sitting still and listening to the teacher). Tosti (59) has been successfully running a Job Corps training program in which contingency management techniques have been utilized.

In general, results of studies with laboratory animals, retarded and psychotic human subjects, children and adolescents with behavior problems, Job Corps trainees, and normal children of nursery school age indicate that contingency management techniques provide fast, practical, effective, and long-lasting behavioral control.

Several studies have been attempts to probe specific aspects of motivation and the management of motivation. Kowitz (60) discussed resistance to innovation among school personnel; Galbraith (61) and Zimmerman (62) studied the motivational variables that influence performance.

A survey form, developed by Cautela and Kastenbaum (63), was designed to determine personalized reinforcing events, situations, and objects. Aronson and Landy (64) demonstrated that the amount of time needed to complete a task expands according to the amount of time allowed for it; this suggested that no time limit be set for students of self-paced instruction. Mithaug and Burgess (65) studied the effects of individual and group reinforcement on group responses. Individual reinforcement was shown to be necessary and sufficient for eliciting a group response while group competition was found to be an ineffective motivator (66).

Indications for Application of Contingency Management Techniques

Because contingency management involves the reinforcement of discrete portions of desired behavior, this technique requires a training program that has discrete and recognizable training goals. A self-paced program of instruction with explicit training objectives is ideally suited to this task. In addition to attaining the above objective, self-paced

instruction, because of its great and personalized flexibility, provides for expression of individualized degrees of motivation. A student may progress at his own rate, entirely dependent on his ability and the degree to which he is motivated to achieve. It is this latter condition, his motivation, which is heightened or introduced by a program of contingency management.

OBJECTIVES

This project was designed to study the effects of introducing a motivational system into an established, ongoing program of instruction, without altering either the content of the course or the methods or procedures used in the program. The purpose of the experiment was twofold:

(1) To provide for the ongoing military training program a simple means of motivating students; specifically, to provide a program of motivation to accompany self-paced instruction.

(2) To assess the applicability and effectiveness of contingency management techniques in a military setting.

APPROACH

OVERVIEW

Students in an Army clerk-typist self-paced course of instruction were exposed to a system of reinforcement that rewarded faster-than-average progress, remained neutral to average progress, and imposed extra training for slower-than-average progress. Students were awarded, for daily achievement, points that could be applied toward immediately available rewards or allowed to accumulate toward more expensive rewards. Extra training time was made available to everyone on a voluntary basis and was mandatory for those students who fell behind. Fast daily progress through self-paced instruction was rewarded in order to achieve faster completion of the course.

SUBJECTS

The clerk-typist school, Second Training Brigade, at Fort Knox, Kentucky, was selected for the study because it was the only one available using a programed course of instruction. The research population comprised a total of 335 students from six classes. Only Regular Army, draftee, and Women's Army Corps (RA, US, and WAC) trainees were included in the study. No temporary personnel (ER, NG) were used.

Subjects ranged in age from 17 to 26, in General Technical Aptitude Area (GT) score from 72 to 152. Initial typing skill level varied from nonexistent to excellent. Normative data for control and experimental populations are reported in Table 1. It was determined (through interviews and informal surveys) that trainees also differed in degree of their interest in learning typing skills and in their opinions of the value of such skills in civilian life.

EXPERIMENTAL CONDITIONS

Two groups, each consisting of three consecutive overlapping classes, were assigned to control and experimental conditions. There were no significant differences between the

Table 1

Age, GT Score, and Pretraining Typing Speed for Control and Experimental Classes

Variable	Control Classes (*N*=162)	Experimental Classes (*N*=173)
Age Range	17-25	17-26
Mean	19.7	19.7
SD	1.7	1.7
GT Range	79-148	72-152
Mean	112.5	114.2
SD	14.7	15.7
Typing Speed Range	0-39	1-48
Mean	17.9	16.6
SD	9.4	9.5

experimental and control classes with respect to age, GT score, and initial typing ability (see Table 1).

The course of instruction for clerk-typist is composed of 14 academic units and 56 typing lessons. The academic units, which present knowledges concerning such areas as correspondence, Department of the Army publications, constructing routine orders, safeguarding defense information, and so forth, were not included in this experiment.

The typing lessons were the basis of study for this research. These lessons are sequenced to form three levels of skill: Lessons 1-15 provide the basic typing skills through taped presentations; Lessons 16-41 provide training information and practice; and Lessons 42-56 provide additional training information and practice oriented toward military correspondence. For purposes of this experiment the lessons were further grouped into 16 units of two to four lessons each.

Students are grouped by the school according to initial typing skill (before Army training). A High Initial Typing Skill group (Group I) consists of trainees typing at least 24 words per minute; this group receives typing Lessons 17-56. A Medium Initial Typing Skill group (Group II) initially types between 11 and 23 words per minute, and receives Lessons 1-54. A Low Initial Typing Skill group (Group III) initially types 10 words or fewer per minute, and receives Lessons 1-15 (group paced), 16-25, 31, 35, 36, 42, 44-48, and 51. The number of trainees assigned to each skill group during this study is shown in Table 2.

Table 2

Number of Subjects in Experimental and Control Classes for Each Initial Typing Skill Level

Group	*N*	Control Classes				Experimental Classes			
		A	B	C	Total	A	B	C	Total
High Initial Typing Skill	114	22	17	28	67	16	12	19	47
Medium Initial Typing Skill	62	12	7	8	27	10	18	7	35
Low Initial Typing Skill	159	19	24	25	68	35	28	28	91
Total	335	53	48	61	162	61	58	54	173

Experimental Group. Three overlapping classes in the clerk-typist school, beginning on three consecutive Mondays, made up the experimental population. On their first training day, experimental subjects were briefed on their involvement in the research program. They were told that they were participants in a study "to see how well and how quickly" they could learn. It was explained that they could go through the course as quickly as they wished, and that they would receive points for three or more units learned on a given day.

Gross variation in initial ability was taken into account during the study. Group III typists were awarded one and one-half points for the same learning increment for which Group I and II individuals were awarded one point.

Points were exchangeable at any time for a series of time-off rewards and/or movie passes. A trainee was permitted to spend his tokens immediately for an inexpensive reward, such as an afternoon off, or to save them for a more costly one, such as a three-day pass. A list of rewards was on display and was also given to each trainee (see Table 3).

Table 3

Rewards and Their Cost in Points

Reward	Cost in Points
Movie Pass	3
Afternoon Off	4
24-Hour Pass	5
48-Hour Pass	6
3-Day Pass	8

Control Group. The control group comprised three consecutive classes, the last of which had finished before the start of experimental classes. These control classes had been run under a program of motivation devised and conducted within the battalion. This program consisted of a group motivation plan, under which all trainees in the class (regardless of typing group) had to reach a specified level of learning by each Friday afternoon in order for the class to receive Saturday morning off. If any trainee failed to reach that level, the entire class was denied the pass and was required to attend Saturday morning training sessions. The rationale behind this procedure was that "group pressure" would force slower students to exert greater effort and would maintain uniformity of learning speed within the class.

PERFORMANCE MEASURES

All subjects were followed through the approximately four weeks of clerk-typist training. Achievement was measured continuously throughout this period by recording the day on which each unit of instruction was completed. It was school policy for the student to pass a "criterion test" on each training unit before going on to the succeeding unit. For control classes this information was taken from daily progress charts normally maintained by the school. The school did not measure how well any student learned the material—this was assumed to be constant among students, since getting through each unit was a pass-fail matter.

Final typing speed was not included as a study variable because (a) this speed was determined by self-testing; (b) errors were not tabulated, but estimated by each trainee; and (c) there was no typing speed criterion which the student had to meet in order to graduate. In effect, the sole performance measure was time—the amount of time required by the trainee to finish the course.

PROCEDURE

Reward and Point System. Rewards consisting of movie passes and time off were used after a greater variety of reinforcements proved to be ineffective during pilot work.[1] Pretest trainees repeatedly showed that they did not value any reward not involving a pass or a leave.

[1] Top-ranking rewards from the Bialek and McNeil survey (5) were rated by a group of Fort Knox trainees, who also suggested additional rewards. Fourteen preferred items from both lists were used as reinforcements in pilot work. These included free bowling, rides to the PX, reveille exemptions, free sports lessons, etc. (in addition to time off).

The point system was devised to reward even modestly above-average learning, so as to reach unmotivated, underachieving students as well as others. Trainees in Groups I and II received one point, and trainees in Group III one and one-half points whenever three units were learned per day.

Three evening sessions a week were provided for all students who wished to attend voluntarily, and were mandatory for all students who did not reach weekly baseline levels of performance. Mandatory attendance was instituted because of the school's understandable concern that trainees not be permitted to fall behind.

Management of Experimental Classes. A central room, in which school personnel marked and recorded student progress, was occupied for the period of the study (approximately seven weeks) by research assistants in addition to school personnel.

Several enlisted men, assigned to the Armor Human Research Unit and trained for this particular duty, staffed the central room during all school hours and were in attendance during the evening sessions. They were available to maintain research records, to keep the student informed of his accumulated points, and to arrange for desired rewards. At least one enlisted man was present to serve in this capacity every school day from 0800 to 1700 inclusive, Saturday mornings from 0800 to 1200 and during the three weekly evening sessions from 1800 to 2100.

Because of the nature of the school and of the research population, it proved impossible to conduct the study independently of instructor and company cadre involvement. The motivational system was very much affected by the ongoing school program, and suffered irreversible setbacks from students not getting earned passes and school facilities not being available as promised for voluntary extra working sessions. Such occurrences reduced the credibility of the program for the students, and appeared to have a negative effect on student motivation.

RESULTS

An analysis of variance of the number of days taken to complete the course was performed to test the effect of experimental procedure on the three groups in terms of initial typing skill. Results of the analysis are shown in Table 4.

Table 4

Summary of Analysis of Variance

Source	Degrees of Freedom	Mean Square	*F*	*p*
Typing Skill	2	1431.5	110.6	<.01
Method	1	29.4	2.3	*NS*
Typing Skill X Method	2	154.7	12.0	<.01
Error	329	12.9		

The data indicate a significant difference in days required to complete the course as a function of initial typing skill. While the overall effect of the experimental method was not significant, the interaction between initial typing skill and experimental method was significant, indicating that in this study the effectiveness of the method depended on the initial typing skill level.

The numbers of days required by experimental and control classes to complete the course are summarized in Figure 1 for trainees of each initial typing skill level. These data are shown in Table 5.

Table 5

Mean Number of Days to Complete the Course

Initial Typing Skill Level	Control Classes	Experimental Classes	Average
High	13.8	10.4	12.4
Medium	15.9	15.3	15.6
Low	19.2	18.8	19.0
Average	16.4	15.8	16.1

As shown, the experimental procedure was reliably effective only for individuals of above-average initial typing skill. This finding is based on the results of Duncan's Multiple Range Tests, which indicate that only these two means were significantly different.

In general, results show that the experimental approach was effective in motivating trainees of high initial typing ability. Under experimental conditions these high ability trainees finished the course, on the average, four days sooner than did trainees of comparable initial ability in the control classes. For trainees of lower ability there were no significant differences between the control and experimental classes.

Supplementary analyses indicate that although GT score, number of days to complete course, and initial typing skill intercorrelate in the expected direction, and to about the same degree (.25), the differential effect of experimental method found for superior typing skill was not found for high GT level. That is, it took the high GT trainees in the experimental classes as long to complete the course as it did the high GT trainees in the control classes.

Summary of Mean Days Required for Experimental and Control Classes to Complete the Course
(by Initial Typing Skill Level)

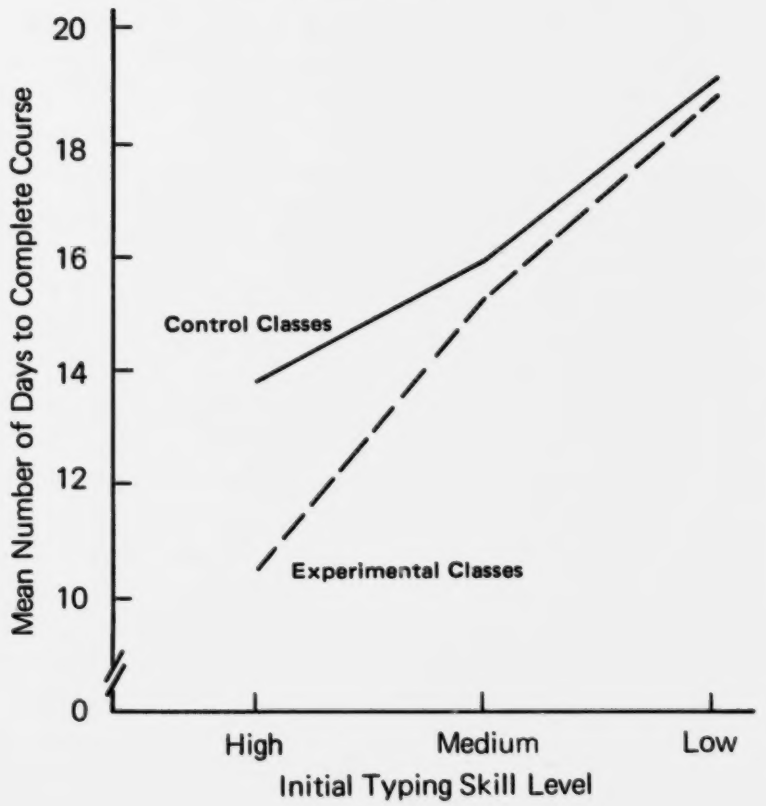

Figure 1

DISCUSSION

Both the work of others and the nature of contingency management as an approach suggest an across-the-board, overall effect. The highly selective impact of contingency management found under the conditions of this study is therefore surprising.

Just why skilled typists were somehow more susceptible to a motivation system, and just why unskilled typists did not react in a similar manner, are questions open to speculation. Skilled typists may be generally more responsive to incentives; they may have profited more from the instruction because of superior study patterns developed elsewhere; the course of instruction may have been better designed for the superior student.

Reasons for the unexpected findings, however, are of academic interest only, because conditions necessary for adequate assessment of the research variable, assumed to be present, did not in fact exist. It had been assumed that the course of instruction was proceeding on a self-paced basis, and that the outlined reinforcement procedure could be implemented. As the study progressed, it became obvious that certain factors in the military training operation were in conflict both with the aims of self-paced instruction and with those of reinforcement management. Retention of the concept of a fixed time for completion of a self-paced course, adjustment of course content and standards to ensure conformity of performance and time schedule, and imposition of a group motivation plan on an individualized self-paced course of instruction are examples of such conflicts.

To counteract recurrence of similar problems in other training establishments, people involved in the management of training should be schooled in the objectives and conduct of new methods and in the importance of the format (means) and standards (ends) that pertain to any educational program. A pretest period of controlled and evaluated administration of the new program would be helpful.

Army training managers often attempt, with good intentions, to develop and employ extrinsic motivational techniques. However, linking incentives to the achievement of the slower students and "rewarding" early achievers with extra detail operate to condition the student away from superior performance. The administrators of training would function far more effectively if they were supplied with a manual on the selection and use of motivational techniques, and on the implications of their actions on the development and maintenance of student motivation.

In summary, the effectiveness of contingency management, no less than the effectiveness of *any* innovative educational program, is dependent on many complex factors in the training environment. Successful innovation requires preparatory modification of the entire administrative system. Such new techniques as self-paced instruction cannot be effective when they are superimposed on, or forced to fit into the context of, an existing system. Successful implementation requires that administrators be trained in the operation of the new technique, that detailed guidelines for administering it be made available, and that checkpoints for monitoring management of the innovation be incorporated into the program.

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13. ABSTRACT

To study the effectiveness of reinforcement management (contingency management) as applied to a military program of instruction already in operation, 335 students in an Army clerk-typist course in which self-paced instruction is employed were given points for successive approximations to desired learning behavior. The points were exchangeable later for varying lengths of time off. Only trainees of high initial typing skill were found to have been significantly affected by the experimental program. The selective impact of contingency management found in this population is examined in terms of present military conduct of self-paced instruction, and in terms of military management of motivation and training.

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